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ICNAF Division 5Y Herring and ICNAF Division 5Z
and Statistical Area 6 Herring Stock Assessments

by

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ICNAF DIVISION 5Y HERRING

Catch Statistics

The catch of adult herring in Division 5Y in 1977 was 20,204 tons. This amount was in excess of a recommended total allowable catch of 7,000 tons set by ICNAF in January, 1976. The excess was attributable to the U.S.A. exceeding their quota by 13,204 tons. The Division 5Y juvenile catch in 1976 was 30,195 tons; this fishery has never been included in the assessment.

Fishing Mortality and Year Class Size

The catch of 20 204 tons corresponded to an $F = 0.55$ on fully recruited age groups as indicated in stock projection for 1976 (ICNAF Redbook, 1976, p. 43). This value of F was used as a starting value in cohort analysis for fully recruited age groups (1969 year class and earlier). Starting F 's for the 1970, 1971, and 1972 year classes were adjusted using partial recruitment values of .871, .708, and .475 respectively (values used in previous ICNAF assessment). Using these F values and cohort analysis gave recruitment values at age 2 for the 1971 and 1972 year classes of about 126 million and this value of recruitment was assumed for the 1973 and 1974 year classes. For stock projection to 1977 and 1978, the recruiting 1975 and 1976 year classes were also assumed to be of this size.

Cohort Analysis

Results of the cohort analysis are in Table 1. Stock size at the beginning of 1976 is close to the ICNAF minimum level of 60,000 tons for this stock. Mean F (for age 3 and older) is at about $F_{0.1} = .38$ for this stock.

Stock Projection

A TAC of 7,000 tons for this stock in 1977 was set by ICNAF in 1976 and projection through to the start of 1978 was carried out assuming a catch of 7,000 tons. This generated an $F = .195$ on fully recruited age groups. Figure 1 indicates catch (age 2 and older) in 1978 and stock size (age 4 and older) at the start of 1979 for varying levels of F.

To stay within the recommended minimum stock size constraint of 60,000 tons, the TAC for 1978 should be 4,500 tons corresponding to an $F = .12$ on fully recruited age groups. To allow for some stock rebuilding, the TAC should be lowered to a level of 2,000 tons allowing a stock size (age 4 and older) of 63,000 tons at the start of 1979.

ICNAF DIVISION 5Z and STATISTICAL AREA 6 HERRING

Catch Statistics

The TAC for this stock in 1976 was set at 60,000 tons. The reported catch by all countries for this stock in 1976 was 42,136 tons.

Fishing Mortality and Year Class Size

The catch of 42,136 tons corresponded to an $F = 0.25$ on fully recruited age groups (ICNAF Redbook, 1976, p. 46). This value of F was used in the analysis for fully recruited age groups (1971 year classes and earlier). Partial recruitment factors were recalculated for age 2, 3, and 4 fish using mean F's generated in a preliminary cohort run for the fishery years 1970-1974 inclusive. Starting F's for the 1972, 1973, and 1974 year classes were calculated using these partial recruitment values as applied to the $F = 0.25$ for fully recruited age groups.

Past assessments of this stock have used an assumed recruitment at age 3 of 550 million but this value seems high considering the present trends. Mean recruitment as indicated by cohort analysis for the 1968 to the 1974 year classes (but excluding the exceptional 1970 year class) is about 400 million at age 2 and this was the value used for recruitment for stock projections in 1977 and 1978.

Cohort Analysis

The results of cohort analysis are in Table 2. Stock size at the start of 1976 fall below the ICNAF minimum stock size constraint of 225,000 tons. Mean $F = .218$ (for age 3 and older) however is well below $F_{0.1} = .38$ for this stock.

Stock Projection

A TAC of 33,000 tons was set for this stock in 1977. However, the only countries allowed to have a directed fishery on this stock in 1977 are Canada and the U.S.A.; their combined share of the TAC is 13,000 tons. Consequently, two projections were run for 1977 using assumed catches of 13,000 tons and 33,000 tons and these catches generated F's of .088 and .240 respectively. Figure 2 indicates the stock size (age 4 and older at the start of 1979) and 1978 catch (age 2 and older) for varying levels of F using the two different assumptions of 1977 catch. A catch of 0 in 1978 with either assumptions of 1977 catch still leaves stock size at the beginning of 1979 below the minimum ICNAF level of 225,000 tons. However, in order to have some idea of 1978 age structure and recruitment from catch sampling, a limited fishery of about 2,000 tons should be allowed for this fishery in 1978.

Table 1. 5Y herring.

	2	3	4	5	Age (years)						Age 3 and older		Age 4 and older	
					6	7	8	9	10	10+	Number(x10 ⁻⁶)	Weight(x10 ⁻³)	Number(x10 ⁻⁶)	Weight(x10 ⁻³)
Stock size (x10 ⁻³)														
1957	280937	200598	181238	170565	164247	88323	14932	6606	3189	197	830	165	629	142
1958	329381	229593	163949	145714	132942	122380	64896	11714	5098	2316	879	161	649	153
1959	193347	269164	172256	118425	92645	82350	74884	36495	6726	1991	855	171	586	139
1970	148033	154285	185045	135428	86046	55515	43338	42196	19901	3151	727	152	572	134
1971	87415	118146	117878	127641	94275	47805	21072	14359	9218	3830	554	115	435	100
1972	618139	70996	75802	75992	73758	43933	15310	2765	1785	899	361	75	290	67
1973	126491	466558	42752	28142	26243	21933	11093	4077	967	275	622	90	136	31
1974	126591	101548	381789	29844	13597	9554	5611	2483	1424	411	546	96	445	84
1975	126132 ¹	100125	69613	255740	17897	6523	4593	1888	734	441	457	89	357	77
1976	126000 ¹	102370	65095	40490	155685	10190	1902	2277	468	172	379	75	276	62
Catch (x10 ⁻³)														
1967	21	317	2953	7410	13366	8197	565	343	326	167	34	8	33	8
1968	564	17734	17467	29458	29280	27974	18387	3166	2412	1960	148	35	130	32
1969	1722	39344	6192	9850	22476	26618	21124	11028	2604	1685	141	32	102	27
1970	3419	9327	26370	18350	25835	26943	23344	27993	13774	2666	176	45	165	44
1971	634	23129	22673	33979	36750	26335	16011	11020	7347	3241	180	42	157	40
1972	21243	16992	37487	39758	42199	27493	9347	1434	1311	761	177	39	160	37
1973	2226	18594	5701	10437	13187	13645	7293	2116	420	233	72	16	53	13
1974	3979	14950	62821	7224	5094	3568	2991	1436	801	348	99	19	84	17
1975	330	18556	18240	59343	4932	3800	1640	1191	474	373	109	22	90	20
1976	87	22541	13612	11903	54132	3943	736	881	181	126	108	22	86	20
Fishing mortality												F ²		
1957	.000	.002	.018	.049	.094	.108	.043	.059	.120	1.100		.046		
1958	.002	.089	.125	.253	.279	.291	.376	.355	.740	1.100		.205		
1959	.010	.175	.041	.096	.312	.442	.374	.406	.558	1.100		.202		
1970	.025	.059	.171	.162	.411	.769	.905	1.321	1.448	1.100		.311		
1971	.008	.244	.239	.348	.564	.939	1.831	1.885	2.127	1.100		.447		
1972	.039	.307	.791	.863	1.013	1.176	1.123	.851	1.669	1.100		.776		
1973	.020	.043	.159	.527	.810	1.163	1.297	.852	.654	1.100		.135		
1974	.035	.178	.201	.311	.535	.532	.889	1.019	.972	1.100		.225		
1975	.003	.231	.342	.296	.363	1.032	.502	1.195	1.252	1.100		.304		
1976	<.001	.275	.261	.389	.479	.550	.550	.550	.550	.550		.376		

¹Recruitment at age 2 assumed the same as for 1971 and 1972 year-classes.

²Mean F (for age 3 and older) weighted by stock size in numbers.

Table 2. 5Z + 6 herring.

Year	Age (years)								Age 3 and older		Age 4 and older	
	2	3	4	5	6	7	8	8+	Number(x10 ⁻⁶)	Weight(x10 ⁻³)	Number(x10 ⁻⁶)	Weight(x10 ⁻³)
Stock size (x10 ⁻³)												
1967	1757870	1251220	1558840	1006220	1345930	1267270	123190	42120	6595	1400	5344	1225
1968	1884280	1437590	1018170	1221440	726100	875110	694440	56160	6027	1295	4590	1094
1969	1214950	1540450	1129860	768410	696000	383290	324780	263990	5106	1048	3566	832
1970	890210	994720	1220050	734310	378430	318210	143250	93530	3882	773	2687	634
1971	792170	709250	700940	591260	356630	199170	176470	70600	2804	573	2095	473
1972	4983250	635900	279630	324600	226570	139210	69050	98870	1776	358	1139	269
1973	359360	4059520	469780	129570	72120	42530	18330	15820	4829	725	769	157
1974	82460	285600	2395290	160310	48170	29190	14010	4150	2936	531	2650	491
1975	132830	65790	197720	1410140	69180	27770	18380	8310	1797	387	1731	378
1976	147380	107490	43640	92390	699390	25330	11420	9440	987	224	880	209
Catch (x10 ⁻³)												
1967	1800	6900	60600	108000	250700	379200	49400	21300	876	222	869	221
1968	2500	52100	72000	336000	233400	432900	336600	28400	1491	370	1439	372
1969	0	45500	210800	277100	278100	188500	190500	133500	1324	326	1279	320
1970	12600	125400	450500	270300	122300	92900	51600	47300	1160	245	1035	227
1971	12900	332500	275500	284600	175800	103900	50400	35700	1258	257	925	210
1972	28000	35000	110000	214000	158000	100000	45000	50000	712	168	677	153
1973	10000	1026000	266000	64000	33000	23000	12000	8000	1432	226	406	83
1974	1900	39900	608900	66500	12900	6100	3500	2100	742	137	702	131
1975	1400	11300	76800	503000	34600	12500	6200	4200	649	141	637	140
1976	500	7500	6800	18600	140800	5100	2300	1900	183	43	176	42
Fishing mortality										F1		
1967	.001	.006	.044	.126	.230	.402	.586	.800		.162		
1968	.001	.041	.081	.362	.439	.791	.767	.800		.325		
1969	.000	.033	.231	.508	.583	.784	1.045	.800		.370		
1970	.016	.150	.524	.522	.442	.390	.508	.800		.417		
1971	.018	.730	.570	.750	.787	.859	.379	.800		.701		
1972	.006	.063	.570	1.304	1.473	1.781	1.274	.800		.637		
1973	.031	.328	.917	.789	.705	.910	1.285	.800		.400		
1974	.026	.168	.330	.640	.351	.263	.323	.800		.328		
1975	.012	.211	.561	.501	.805	.688	.467	.800		.514		
1976	.004	.080	.188	.250	.250	.250	.250	.250		.218		

1 Mean F (for age 3 and older) weighted by stock size in numbers.

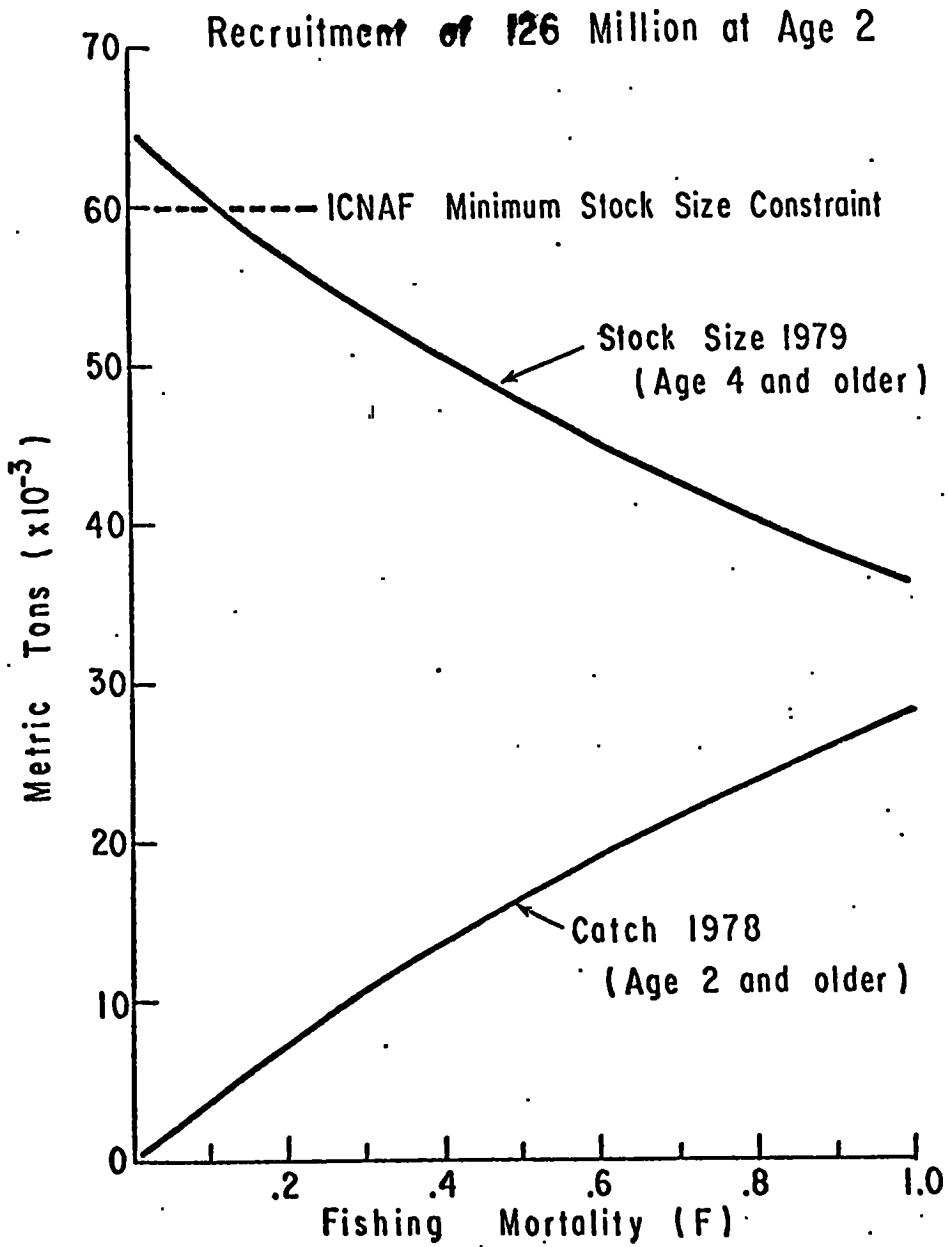


Fig. 1. Catch (1978) and stock size (1979) - 5Y herring.

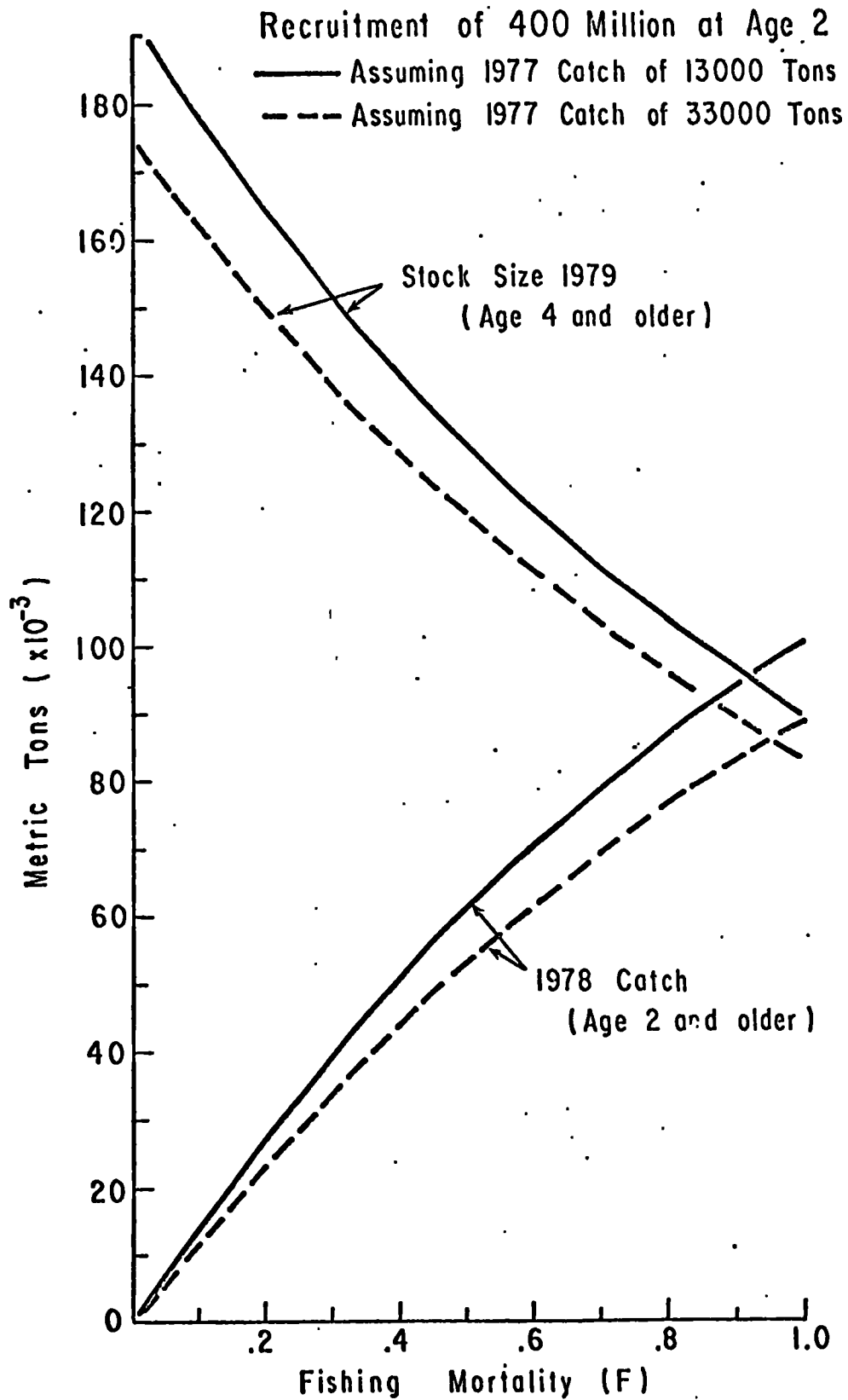


Fig. 2. Catch (1978) and stock size (1979) - 5Z + 6 herring.